

Course Unit	Heat and Mass Transfer Processes		Field of study	Technology of Chemical Processes														
Bachelor in	Environmental Engineering		School	School of Agriculture														
Academic Year	2022/2023	Year of study	2	Level	1-2													
Type	Semestral	Semester	1	ECTS credits	6.0													
Code	9099-309-2102-00-22																	
Workload (hours)	162	Contact hours	T	30	TP	-	PL	30	TC	-	S	-	E	-	OT	20	O	-

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s) Elsa Cristina Dantas Ramalhosa

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:

1. Identify the processes involved in heat transfer;
2. Calculate the amount of heat transferred in unidimensional systems without and with heat generation;
3. Determine temperature profiles;
4. Determine thermal diffusivities of food products;
5. Determine the amount of heat transferred through extended surfaces, namely fins;
6. Dimension heat exchangers;
7. Calculate the diffusion rate of a particular compound;
8. Determine the values of mass diffusivities and the existence of equilibrium between two fluids in contact.

Prerequisites

Before the course unit the learner is expected to be able to:
Solve problems that involve differential and integral calculus.

Course contents

Part I - Basic Knowledge of heat transfer; Part II - Basic Knowledge of mass transfer.

Course contents (extended version)

1. Chapter I: Heat Transfer:
 - Introduction;
 - Steady-state conduction without and with internal production of energy;
 - Convection;
 - Systems of conduction - convection: fins;
 - Thermal Isolation;
 - Unsteady-state conduction;
 - Heat exchangers;
 - Radiation.
2. Chapter II: Mass Transfer:
 - Introduction. Mechanisms of mass transfer – molecular mass transfer and convective mass transfer;
 - Fick's First Law;
 - Mass transfer between phases;
 - Rate equation for convective mass transfer;
 - Solute distributed between two fluids in contact: equilibrium, interfacial transfer;

Recommended reading

1. C. J. Geankoplis, Transport Processes and Unit Operations, Prentice Hall (1993);
2. J. P. Holman, Transferência de calor, McGraw – Hill (1983);
3. F. P. Incropera and D. P. DeWitt, Fundamentals of Heat and Mass Transfer, John Wiley (1996);
4. Y. A. Çengel, Heat Transfer - A practical approach, McGraw-Hill (2003).
5. R. P. Singh and D. R. Heldman, Introduction to Food Engineering, Academic Press, 3rd Edition (2001)

Teaching and learning methods

Theoretical lessons: the professor will present the diverse subjects, appealing to the expositive method, using black board, overhead projector and/or data-show, and in several situations to the demonstrative method. Theoretic-Practical lessons: resolution of exercises, using the demonstrative and active methods; Experimental works.

Assessment methods

1. Avaliação (I) - (Regular, Student Worker) (Final)
 - Final Written Exam - 80% (During the semester, 3 small exams will be made. The final mark will be the mean.)
 - Case Studies - 20% (During the semester the teacher will ask the students to solve case studies.)
2. Avaliação(II) - (Student Worker) (Final, Supplementary, Special)
 - Final Written Exam - 100%

Language of instruction

Portuguese

Electronic validation

Elsa Cristina Dantas Ramalhosa	António Manuel Coelho Lino Peres	Artur Jorge de Jesus Gonçalves	José Carlos Batista Couto Barbosa
07-12-2022	07-12-2022	08-12-2022	09-12-2022